Leveraging on digitalization to optimise DH Networks

*DHC+ Talk, 4th June 2020*
**Intro to the `grade`DH project**

**Upgrading the Performance of District Heating Networks in Europe**

- Upgrading Process of 8 DH systems in various EU regions across whole value chain (production, distribution, consumption)
- Development of Best practices and Tools reviews, Handbook, DH image raising material, etc.
- Vast range of Improvements with significant impacts on PED & GHG reduction
- Support to regional / national action plans
- Focus on replicability

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Optit: key info

Spin-off of the Alma Mater Università di Bologna, we design, develop and provide state-of-art Solutions and Services based on Advanced Analytics and Optimization.

We integrate the talent of over 40 skilled Data Scientists, Business Consultants and SW Engineers to support the development of Digital Innovation solutions.

We work for medium and large enterprises in several industries (Energy, Waste, Logistics, Retail), unlocking exceptional returns on investments (ROI).

Bologna: Consultancy Services and Commercial HQ

Cesena: Software Factory
Multiple Decision Making processes towards DH Network Optimization

**INVESTMENT**
- Where and how to build/expand the DH Network
- Refurbishment strategies for existing pipelines
- No historic field data
- Lots of possible alternatives (what-if analyses)
- Very large investments
- Focus on Technical Feasibility and ROI

**LONG TERM PLANNING**
- Tactical / commercial development of DHC network
- Analysis of thermal-hydraulic issues
- Availability of field data (historical / real-time)
- Operations management (pumping, supply security, maintenance)
- Focus on Operating Margins

**SHORT TERM PLANNING**
- Heat Dispatching and Management
- Temperature optimization

**OPERATIONAL**
- Monitoring and control of key network parameters
- Pumping optimization
- Operations management (pumping, supply security, maintenance)
- Focus on Operating Margins
DH Network Development & Strategic Optimization

### BUSINESS OBJECTIVES

- District Heating Network Development Design
- Return on Invested Capital (Net Present Value optim)
- Optimization/improvement of Existing Networks

### DECISION MAKING DRIVERS

- Network Geographical Extension management
- Complex Thermal-Hydraulic configurations
- Economic Evaluation of Investments, Costs & Revenues
- Multiple Scenarios Evaluation
Scenario set-up & configuration challenges
Advanced scenario analysis (thermal-hydraulic simulations)

### KPI Overview

<table>
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<th>KPI</th>
<th>S1A</th>
<th>S2A</th>
<th>S3A</th>
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<tr>
<td>Num. Critical Pipes (Diff. Press)</td>
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<td>139</td>
<td>138</td>
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<tr>
<td>Num. Critical Pipes (Head Loss)</td>
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<td>28</td>
<td>30</td>
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<tr>
<td>Max Pressure Supply Line (mbar)</td>
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<td>10764</td>
<td>11051</td>
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<tr>
<td>Min Pressure Return Line (mbar)</td>
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### Top 5 MIN Diff. Pressure (mbar)

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<th>Rank</th>
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<th>Diff. Pressure (mbar)</th>
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### Top 5 MAX Flow Speed (m/s)

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<td>5</td>
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Network Development Optimization

Optimal Solution

• Most valuable customers to be connected
• Backbone and service pipes to be extended with optimal diameter;
• Hydraulic feasibility of perspective scenarios
• Possibility to evaluate alternative scenarios wrt technical or economic variations
• Investment value: costs, revenues, cash flows, NPV
Large range of development analysis use cases

**NEW NETWORK DEVELOPMENT**
- ROIC Optimization
- Optimal Network Design
  (vs. thermo-hydraulic feasibility)
- KPIs Analysis for every scenario

**NETWORK EXPANSION**
- Client acquisition Plan
- Design Optimization
- Technical Simulations of future network configurations

**SATURATED NETWORK**
- Demand Reduction
- Contracts Review Analysis
- Optimization of Heat Generation for future development
Integration of Engineering & Economic Analysis

**INVESTMENT EVALUATION**

- Analysis of network expansion investments
- Impact analysis of new equipment integration
- Evaluation of Policy & Tariff Frameworks

**TECHNICAL ANALYSIS**

- Detailed Hydraulic Model to analyse critical areas
- Network Design Analysis and Optimization
- Risk and Maintenance Assessment
From Analysis to Construction: the case of Via Martinetti - Milan

DECISION DRIVERS INTEGRATION

The Tool supported the transition from the commercial to the engineering departments, speeding up the project execution.
Main applications in the UpgradeDH project

- Evaluation of multiple grid expansion scenario
- Analysis of alternative hydraulic designs
- What-if analysis of possible alternative designs
- Refurbishment strategies
- New users connection optim.
- Study of low temp secondary grid hypothesis
Analysis of interconnection opportunities in the Belgrade network

- New perspective users to be connected (88 MWth)
- New (greener) sources: Thermal Plant (600 MWth) + WTE (56 MWth)
- Planned construction of new piping and refurbishing of existing piping

- Temperature-based regulation in Zemun - NB
- Flow-based regulation in Konjarnik-NB-Dunav system
Thank you for your attention!

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